

But more than this, not only does the train take off current from the section 1 when it is just leaving it, and entering section 2, but no following train entering section 1 can receive current or motive power until the preceding train has entered section 3. [Experiments were then shown proving that with this system a following train could not possibly run into a preceding train even if the preceding train stopped or backed.] Now why does the following train when it runs on to a blocked section pull up so quickly? The reason is because it is not only deprived of all motive power, but is powerfully braked, since when electricity is cut off from a section, the insulated and non-insulated rail of that section are automatically connected together, so that when the train runs on to a blocked section the electromotor becomes

a generator short circuited on itself, producing, therefore, a powerful current which rapidly pulls up the engine. [Experiments were then shown of the speed with which an electromotor, which had been set in rapid rotation and then deprived of its motive current, pulled up when its two terminals were short-circuited.]

Whenever, then, a train, it may be even a runaway engine, enters on a blocked section, not only is all motive power withdrawn from it, but it is automatically powerfully braked, quite independently of the action of the engine-driver, guard, or signalman. No fog, nor colour-blindness, nor different codes of signals on different lines, nor mistakes arising from the exhausted nervous condition of overworked signal-men, can with this system

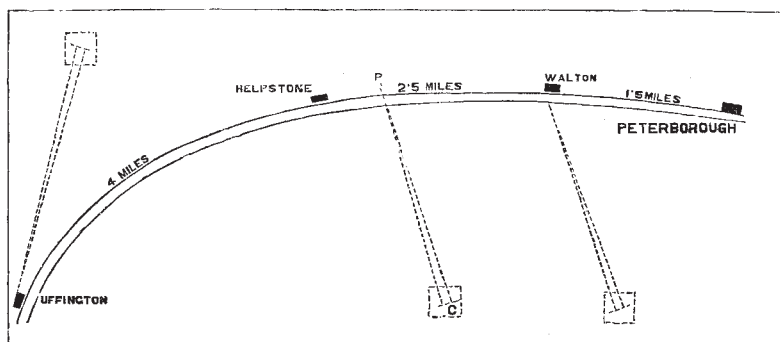


FIG. 5.

produce a collision. The English system of blocking is merely giving an order to stop a train; but whether this is understood or intelligently carried out is only settled by the happening or non-happening of a subsequent collision. Our Absolute Automatic Block acts as if the steam were automatically shut off and the brake put on whenever the train is running into danger; nay, it does more than this—it acts as if the fires were put out and all the coal taken away, since it is quite out of the power of the engine-driver to re-start his train until the one in front is at a safe distance ahead.

But all trains will undoubtedly be lighted with electricity; must, then, the train be plunged into darkness when it runs on to a blocked section to which no electric energy is being sup-

plied? No! If some of the electric energy supplied to a train when it is on an unblocked section be stored up in Faure's accumulators, such as are at present used on the Brighton Pulman train, the lamps will continue burning even when the train has ceased to receive electric energy from the rubbed rail.

When, then, we commit the carrying of our power to that fleet messenger to which we have been accustomed to entrust the carrying of our thoughts, then shall we have railways that will combine speed, economy and safety; and last, but not least to us Londoners, we shall have the entire absence of smoke, the presence of which nearly causes the convenience of the Underground Railway to be balanced by the pernicious character of its atmosphere.

## SOCIETIES AND ACADEMIES

### LONDON

Royal Society, December 21, 1882.—“On the Origin of the Hydrocarbon Flame Spectrum.” By G. D. Liveing, M.A., F.R.S., Prof. of Chemistry, and J. Dewar, M.A., F.R.S., Jacksonian Prof., University of Cambridge.

In previous communications<sup>1</sup> to the Society we have described the spectra of what we believe to be three compound substances, viz., cyanogen, magnesium-hydrogen, and water.

In these investigations our chief aim has been to ascertain facts, and to avoid as far as possible adopting any special theory regarding the genesis of the spectra in question.

Specific spectra have been satisfactorily proved to emanate from the compound molecules of cyanogen, water, and magnesium-hydrogen, so far as we can interpret in the simplest way the many observations previously detailed. The fact that a fluted spectrum is produced under certain conditions, by a substance which does not give such a spectrum under other conditions, is of itself a proof that the body has either passed into an isomeric state or has formed some new compound; but we are not entitled to assert, without investigation, which of these two reasonable explanations of the phenomena is the true one. There is, however, a spectrum to which we have had occasion to refer in the papers on the spectra of the compounds of carbon, which closely resembles that of a compound substance, and which we, in common with some other spectroscopists, have been led to attribute to the hydrocarbon acetylene, without, however, being

able to bring forward such rigid experimental proofs of its origin as we have adduced in the case of the three substances above referred to. In other words, the experimental evidence that the hydrocarbon flame spectrum is really due to a hydrocarbon was always indirect. Thus, we showed that many flames containing carbon, such as those of hydrogen mixed with bisulphide of carbon or carbonic oxide, and the flame of cyanogen in air, did not give this spectrum, and these particular flames are known, from the investigations of Berthelot, to be incapable of generating acetylene under conditions producing incomplete combustion. On the other hand, we found that a flame of hydrogen mixed with chloroform, which easily generates acetylene, gives the hydrocarbon flame spectrum in a very marked manner, and it is known that the ordinary blow-pipe flame, in which the same spectrum is well developed, contains this hydrocarbon.

These and other experiments point to the intimate relation of hydrogen and carbon in the combined form of acetylene to the production of this spectrum during combustion. In our various observations on the spectrum of the electric arc taken in different gases, the flame spectrum was always noticed, and seemed to be independent of the surrounding atmosphere. In the mode in which those experiments were conducted, it was easily shown that the carbons were never free from hydrogen, and that the gases always contained traces of aqueous vapour. Under these conditions acetylene is formed synthetically during the electric discharge, the line spectrum of hydrogen being absent; so that we were never convinced that the spectrum was not due to the former substance.

It is well to remark in passing, that our previous work on the spectrum of the carbon compounds was mainly directed to that particular spectrum which is characteristic of the flame of cyanogen, and only indirectly to the flame spectrum of hydrocarbon. We were further supported in connecting the latter

<sup>1</sup> “On the spectra of the Compounds of Carbon with Hydrogen and Nitrogen.” I and II. *Proc. Roy. Soc.*, vol. 30, pp. 152, 494. “On the Spectrum of Carbon,” *ib.*, vol. 33, p. 403. “General Observations on the Spectrum of Carbon and its Compounds,” *ib.*, vol. 34, p. 123. “On the Spectrum of Water,” *ib.*, vol. 30, p. 480, and vol. 33, p. 274. “Investigations on the Spectrum of Magnesium,” *ib.*, vol. 32, p. 189.

spectrum with acetylene, by observing that cyanogen compounds are continuously formed when the arc discharge takes place in gases containing nitrogen, and that in all probability their formation is due, as Berthelot has shown, to a reaction taking place between acetylene and nitrogen. Berthelot is positive in his assertions that cyanogen is never formed by a direct combination between carbon and nitrogen, and any such apparent combination is due to impure carbon, and the presence of an imperfectly dried gas; in other words, hydrogen is essential to the production of cyanogen under such conditions according to the views of Berthelot.

The fact that carbonic oxide, which is one of the most stable binary compounds of carbon, forms a distinct spectrum of a character similar to that of the flame spectrum, tended to support the view that the flame spectrum might originate with acetylene. The similarity in the character of the magnesium-hydrogen spectrum to that of the hydro-carbon flame spectrum induced us to believe that they were due to similarly constituted compounds, and seeing we felt sure about the accuracy of the view, which assigns the former spectrum to some compound of magnesium with hydrogen, we accepted the analogy in favour of the supposition that acetylene is the substance which produces the flame spectrum; or, at any rate, that acetylene is a necessary concomitant of the reaction taking place during its emission, and consequently might give rise to this peculiar spectrum.

Having examined this question in the way described, we adopted the view of Angström and Thalén as to the genesis of this spectrum in opposition to the views of Attfield, Morren, Watts, Lockyer, and others, who held that this spectrum was really due to the vapour of carbon. The delicate character of the experiments which were required to discover the origin of the peculiar set of flutings in the more refrangible part of the spectrum of cyanogen made it apparent that, whatever views as to the origin of the hydrocarbon flame spectrum were adopted by different workers, it could not be regarded hitherto as experimentally proved which was the correct one.

With the object of being able to exhaust this question, a special study was subsequently made of the ultra-violet line spectrum of carbon, in order to ascertain whether any of its lines could be found in the spectra of the arc or flame. We have found that the ultra-violet lines of metallic substances have as a rule the greatest emissive power, and are often present when no trace of characteristic lines in the visible part of the spectrum can be detected. If carbon resembled the metals in this respect, then we might hope to find ultra-violet lines belonging to its vapour, thus enabling us to detect the volatilisation of the substance at the relatively low temperatures of the arc and flame. The test experiments made on this hypothesis are recorded in the paper entitled "General Observations on the Spectrum of Carbon and its Compounds." It is there shown that some seven of the marked ultra-violet spark lines of carbon occur in the spectrum of the arc discharge, although one of the strongest lines, situated in the visible portion of the spectrum at wave-length 4266, could not be found. Further, it is proved that the strongest ultra-violet line of carbon does occur in the spectrum of the flame of cyanogen fed with oxygen. Thus it seems probable that the same kind of carbon molecule exists, at least in part, in the arc and flame, as is found to be produced by the most powerful electric sparks, taken between carbon poles or in carbon compounds.

Now the spark gives us the spectrum which is associated with the highest temperatures, and therefore it is assumed that this spectrum is that of the simplest kind of carbon vapour. If that be the case, we cannot avoid inferring that denser forms of carbon vapour must exist in arc and flame, emitting, like other complex bodies, a fluted, in contrast to a line, spectrum; or rather that the two distinct kinds of spectra may be superposed. Such considerations showed that a series of new experiments and observations must be made with the special object of reaching a definite conclusion regarding the origin of the flame spectrum, and the following paper contains a summary of the results of such an inquiry.

*Vacuous Tubes.*—We have heretofore laid little stress on observations of the spark in vacuous tubes on account of the great uncertainty as to the residual gases which may be left in them. The film of air and moisture adherent to the glass, the gases occluded in the electrodes, and minute quantities of hydrocarbons of high boiling-point introduced in sealing the glass, may easily form a sensible percentage of the residue in the exhausted tube, however pure the gas with which it was originally filled. The

excessive difficulty of removing the last traces of moisture we learnt when making observations on the water spectrum, and the almost invariable presence of hydrogen in vacuous tubes is doubtless due in great measure to this cause. Wesendonck (*Proc. Roy. Soc.*, vol. 32, p. 380) has fully confirmed our observations as to this difficulty. By a method similar to that employed by him, we have, however, succeeded in so far drying tubes and the gases introduced into them that the hydrogen lines are not visible in the electric discharge. For this purpose the (Pliicker) tube was sealed on one side to a tube filled for some six or eight inches of its length with phosphoric anhydride, through which the gas to be observed was passed, and on the other side to a similar tube full of phosphoric anhydride, which was in turn connected by fusion to the (Sprengel) pump. To dry the gas it is not enough to pass it through such a tube or even a much longer one full of phosphoric anhydride; it has to be left in contact with the anhydride for several hours, and to get the adhering film of moisture out of the tube it has to be heated after exhaustion while connected, as above described, with the drying tubes up to the point at which the glass begins to soften, and kept at near this temperature for some time. To get most of the gases out of the electrodes, the tube must be exhausted and sparks passed through it for some time before it is finally filled with the gas to be observed. Even when these precautions have been observed, the lines of hydrogen can often be detected in tubes filled with gases which should contain no hydrogen. The general result of our observations on the spectra observed in tubes so prepared is that the channelled spectrum of the flame of hydrocarbons is not necessarily connected with the presence of hydrogen; it does not come and go according as hydrogen is or is not present along with carbon in the way that the channelled spectrum of cyanogen comes and goes according as nitrogen is present or absent. Our observations confirm those of Wesendonck on this point. This spectra given by various tubes containing carbon compounds are described in the paper.

Tubes filled with carbonic oxide exhibit in general at different stages of exhaustion the following phenomena. When the exhaustion is commencing and the spark will just pass, the spectrum is usually that of the flame of hydrocarbons and nothing else. As the exhaustion proceeds, the spectrum of carbonic oxide makes its appearance superposed on the former, and gradually increases in brilliance until it overpowers, and at last at a somewhat high degree of exhaustion, entirely supersedes the flame spectrum. This is when no jar is used. In the earlier stages of exhaustion, the effect of the jar is to increase the relative brilliance of the flame spectrum, and diminish that of the carbonic oxide spectrum, and at the same time to bring out strongly the lines of oxygen and carbon; at a certain stage of the exhaustion, when the flame spectrum is very weak without the jar, the effect of the jar is to bring it out again, but without sensibly enfeebling the carbonic oxide spectrum, and without bringing out the carbon lines. At a still higher stage of exhaustion, when the carbonic oxide spectrum is alone seen without the jar, the flame spectrum is sometimes, not always, brought out by putting on the jar, though the carbon lines again show well. At this stage, at which the flame spectrum is not seen at all, the distance between the striæ in the wide part of the tube is considerable, and much metal is thrown off the electrodes, which are rapidly heated by the discharge. In a tube filled with carbonic oxide mixed with a little air imperfectly dried, when not too highly exhausted, the carbonic oxide spectrum, that of the flame of hydrocarbons, and that of cyanogen, may all be seen at once superposed when no jar is used. With a jar and a tolerably high exhaustion the carbonic oxide spectrum, the hydrocarbon flame spectrum, and the carbon line spectrum, may all be seen at the same time.

*Spectrum of the Spark in Compounds of Carbon at Higher Pressures.*—In the spark taken between poles of purified graphite in hydrogen, the spectrum of hydrocarbon flames is seen, and it increases in brilliance, as the pressure of the gas is increased up to ten atmospheres, and continues bright at still higher pressures so far as we have observed, that is, up to twenty atmospheres. The spark without condenser in carbonic oxide at atmospheric pressure, shows both the spectrum of carbonic oxide and that of the hydrocarbon flame; and as the pressure of the gas is increased, the former spectrum grows fainter, while the latter grows brighter, no jar being used. The line spectrum of carbon is also visible. At the higher pressures the flame spectrum predominates and is very strong. The observations were carried up to a pressure of twenty-two and a half atmospheres. On letting

down the pressure, the same phenomena occur in the reverse order. All the parts of the flame spectrum, as seen in a Bunsen burner, are increased in intensity as the pressure is increased. The fact that the effects of high pressure are so similar to those produced by the use of a condenser at lower pressures, seems to point to high temperature as the cause of those effects. But against this, we have the fact that at reduced pressure we get in carbonic oxide, the carbonic oxide spectrum and the line spectra of carbon and oxygen simultaneously, without that of the hydrocarbon flame. As we cannot doubt that a very high temperature is required to give the line spectrum of carbon, we must suppose that reduced pressure is unfavourable to the stability of the molecular combination, whatever it be, which gives the hydrocarbon flame spectrum. Wesendonck has remarked (*loc. cit.*) that in carbonic acid at pressures too low for the flame spectrum to be developed without a jar, it is only in the narrow part of the tube that the use of a jar brings out that spectrum. It would appear, therefore, that the constraint, due to the confined space in which the discharge occurs, has the same effect, in regard to the stability of the combination producing the spectrum in question, as increase of pressure.

**Cyanogen Flame Spectrum.**—Our former observations "On the Flame Spectrum of Cyanogen Burning in Air" were made on cyanogen gas, prepared from well-dried mercury cyanide, which was passed over phosphoric anhydride, and burnt from a platinum jet fused into the end of the tube. We observed what Plicker and Hittorf had noted, that the hydrocarbon bands were almost entirely absent, only the brightest green band was seen, and that faintly. When gaseous cyanogen is liquefied by the direct pressure of the gas, the researches of Gore (*Proc. Roy. Soc.*, vol. 20, p. 68) have shown that it is apt to be contaminated with a brownish, treacley liquid, which probably arises from the imperfectly purified or dried cyanide of mercury. In order to obtain pure cyanogen, we have prepared quantities of liquid cyanogen, not by compression, but by passing the already cooled gas into tubes placed in a carbonic acid and ether bath. By this method of condensation any easily liquefiable substances are isolated, and any permanently gaseous substance escaped. The samples were sealed up in glass tubes into which different reagents were inserted. After such treatment the cyanogen was used for the production of the flame in dry air or oxygen. The liquid cyanogen was left in contact with phosphoric anhydride, Nordhausen sulphuric acid, and ordinary sulphuric acid. By means of a special arrangement of glass tubing surrounding the flame dry oxygen could be supplied, or oxygen made directly from fused chlorate of potash could, by means of a separate nozzle, be directed on to the flame, and thus perfectly dry and pure gases used for combustion. Liquid cyanogen which had remained in presence of the above reagents gave only the single green hydrocarbon flame line faintly in dry air, all the cyanogen violet sets being strong. When oxygen made directly from chlorate of potash was directed on to the flame, all the hydrocarbon flame sets appeared with marked brilliancy. The set of lines which we have formerly referred to as the three set of flutings of the cyanogen spectrum, showed marked alteration of brilliancy with variations in the oxygen supply. Thus, liquid cyanogen purified by the action of the above reagents, does yield the spectrum of hydrocarbon flames on combustion in pure oxygen. From the great precautions we have taken, we feel sure that the amount of combined hydrogen in the form of water or other impurities in the combining substances must have been exceedingly small, and that the marked increase in the intensity of the flame spectrum, when oxygen replaces air is essentially connected with the higher temperature of the flame, and is not directly related to the amount of hydrogen present. This being the case, it must be admitted that the flame spectrum requires a higher temperature for its production during the combustion of cyanogen than that which is sufficient to cause a powerful emission of the special spectra of the molecules of cyanogen. Now, the two compounds of carbon, which give the highest temperature on combustion are cyanogen and acetylene. Both of these compounds decompose with evolution of heat, in fact, they are explosive compounds, and the latent energy in the respective bodies is so great that if thrown into the separated constituents a temperature of near four thousand degrees would be reached. The flames of cyanogen and acetylene are peculiar in this respect, that the temperature of individual decomposing molecules is not dependent entirely on the temperature generated by the combustion, which is a function of the tension of dissociation of the oxidised products, carbonic acid and water. We have no

means of defining with any accuracy the temperature which the particles of such a body may reach. We know, however, that the mean temperature of the flames of carbonic oxide and hydrogen lies between two and three thousand degrees, and if this be added to that which can be reached by the substance independently, then we may safely infer that the temperature of individual molecules of carbon, nitrogen, and hydrogen in the respective flames of cyanogen and acetylene may reach a temperature of from six to seven thousand degrees.

A previous estimate of the temperature of the positive pole in the electric arc made by one of us, was something like the same value.

The formation of acetylene in ordinary combustion seems to be the agent, through which a very high local temperature is produced, and this is confirmed by the observations of Gouy on the occurrence of lines of the metals in the green cone of the Bunsen burner, which are generally only visible in spark spectra. On this view acetylene is a necessary agent in the production of the flame spectrum during combustion. The fact that the flame spectrum is often invisible when the arc is taken in a magnesia crucible, although the cyanogen spectrum is strong, but may be made to appear by introducing a cool gas or moisture, must be accounted for by an increased resistance in the arc producing temporarily a higher mean temperature. The experiments in course of execution, where the arc will be subject to a sudden increase of pressure, will, we trust, solve this difficulty.

Further evidence of the high temperature of the cyanogen flame is afforded by the occurrence in the spectrum of that flame, when fed with oxygen, of a series of flutings in the ultra-violet, which appear to be due to nitrogen. The series consists of four, or perhaps more, sets, each set consisting of a double series of lines overlapping one another. The lines increase in their distance apart on the more refrangible side, otherwise the flutings have a general resemblance to the B group of the solar spectrum.

The four sets commence approximately at about the wavelengths 2718, 2588, 2479, 2373 respectively. They are frequently present in the spectrum of the arc taken in a magnesia crucible, and show strongly in that of the spark taken without a condenser either in air or nitrogen. As they appear in the spectrum of the spark in nitrogen, whether the electrodes be aluminium or magnesium, and do not appear when the spark is taken in hydrogen or in carbonic acid gas, they are in all probability due to nitrogen. When a large condenser is used they disappear.

**Linnean Society, December 21, 1882.**—Alfred W. Bennett, M.A., in the chair.—Prof. Adolph. Ernst, of Venezuela, and Dr. W. C. Ondaatje, of Ceylon, were elected Fellows.—Prof. T. S. Cobbold exhibited specimens of *Ligules* from the Bream, the Minnow, and the Grebe to compare with those from man. The worm from the Bream is called *L. edulis* by Briganti, and is eaten under the name "macaroni piatti."—Mr. T. Christy called attention to experiments lately made, which show that the Kola nut possesses singular properties of clearing fermented liquors.—Mr. Thos. H. Corry read a paper on the development and mode of fertilisation of the flower in *Asclepias Cornuti*. R. Brown, 1809, J. B. Payer, 1857, and thereafter H. Schacht, have made *Asclepias* the subject of interesting study; Mr. Corry nevertheless has added new observations thereto. He finds that the petals and stamens, which in the early stage originate separately, become afterwards adnate; the stamens, moreover, by their broad filaments form a fleshy pentagonal ring, *i.e.* are monadelphous. The "stigma-disk" is not formed by the fusion of two stigmas, for the styles proper remain distinct throughout their entire extent. The greatest analogy of the flower to that of the Apocynaceæ is at this period; thereafter differences ensue. From a careful study of the different stages of the pollen in *Asclepias* it appears to exhibit a perfectly isolated and peculiar case of formation. The idea that self-fertilisation can take place with the parts *in situ* is shown to be impossible, and the need for insect or artificial aid rendered imperative. Cross-fertilisation is the great law in the *Asclepiads*.—Dr. F. Day read a paper, "Observations on the Marine Fauna of the East Coast of Scotland," founded on a recent survey by H.M.S. *Triton* off Aberdeen, Kincardine, and Forfar. As regards the herring and its migrations, they shift their locality for breeding purposes or in search of food, occasionally being driven from a spot where extensive netting or other causes disturb them. The herring seems of late years to take to deeper water off shore, but at times they appear to return to their old

habitats in the comparatively shallow water. Although it is true that some fisheries—Wick, for instance—have decreased in plenty, at the same time other places, *e.g.* Fraserburgh, have proportionately increased. The fishery records prove that from the beginning of this century onwards there has been a steady annual increase of fish taken, though desponding fishermen aver to the contrary. At Wick, herring of different ages and conditions arrive and depart thrice yearly. Dr. Day recounts the results of his dredgings, and describes the Crustaceans and Mollusks obtained.—An additional report on the Echinoderms collected by Dr. Day, was made by Prof. F. J. Bell, and of the Zoophytes and Sponges by Mr. S. O. Ridley.—Mr. J. G. Baker afterwards read his second contribution on the Flora of Madagascar. In this paper, upwards of 150 new species of monopetalous dicotyledons are characterised. They were gathered chiefly by the Rev. R. Baron, F.L.S., of the London Missionary Society. Among others described are four new genera, one nearly allied to Cinchona, a second of semi-parasitic Scrophulariaceæ, and two of Acanthaceæ; besides these, many representatives of well-known European genera occur.—Prof. T. S. Cobbold read a description of *Ligula Mansoni*, a new human Cestode. He shows it to be extremely probable that the trout's ligule is the sexually immature state of the great broad tapeworm of man. Other interesting genetic relations are established, and several important generalisations discussed.—Additions to the Lichens of the *Challenger* Expedition was a short paper by the Rev. J. M. Crombie.—Mr. J. G. Baker made a second communication, being descriptions of about thirty plants from the Fiji Islands referred to by Mr. J. Horne in his recent work on the economic resources of Fiji.

Victoria Institute, January 1.—A paper upon "Design in Nature," was read by Mr. W. P. James. It was stated that Prof. Stokes, F.R.S., would read a paper at the next meeting.

## PARIS

Academy of Sciences, January 2.—M. Blanchard in the chair.—M. Rolland was elected vice-president for 1883.—The Academy has lost four Members during 1882, viz. MM. Liouville, Decaisne, Bussy (Free Academician), and Wöhler (Foreign Associate); and six Correspondents, viz. MM. Plantamour, Lutke, Billet, Darwin, Cornalia, and Schwann.—Memoir on the vision of material colours, &c. (continued), by M. Chevreul.—Researches on hyponitrites; first part, chemical researches, by MM. Berthelot and Ogier. They study hyponitrite of silver, describing their analyses, and examination of the action of heat and oxidising agents, also calorimetric measurements. The formula  $N_2O_5Ag_2$  agrees best with the results.—Ramifications of *Isatis tinctoria*, formation of its inflorescences, by M. Trécul.—It was announced that the U.S. Congress had invited the President of that country to convoke all nations to a conference with a view to adoption of a common initial meridian and an universal hour.—Reply to the objections presented by MM. Faye and Hirn to the theory of solar energy, by Dr. Siemens.—On a method of photographing the corona without an eclipse of the sun, by Dr. Huggins.—On geodetic circles, by M. Darboux.—On algebraic integrals of linear differential equations with rational coefficients, by M. Autonne.—On a communication of M. de Jonquières relative to prime numbers (continued), by M. Lipschitz.—Remarks on the subject of a note of M. Hugoniot, on the development of functions in series from other functions, by M. du Bois-Reymond.—Does oil act on the swell or on the breaker? by M. Van der Mensbrugghe. His theory applied only to two cases: where calm water, covered with oil, came to be acted on by wind, and where waves break. The relative calm of phosphorescent portions of tropical waters, he attributes not to increase of cohesion of the water (Admiral Bourgeois), but to the innumerable floating objects forming an obstacle to the slip of surface-layers over each other.—Decomposition of formic acid by the effluve, by M. Maquenne. The results are the same as those got by M. Berthelot in decomposing gaseous formic acid in a closed vessel, by heat alone, about 260°.—On the chloride of pyrosulphuryl, by M. Ogier.—On a vibron observed during measles, by M. Le Bel. It is found in the urine in the early stages, and disappears with the fever: is a slightly curved, very refringent rod, moving very slowly; contains oval spores at one-third of its length, in a bag of dead protoplasm, which gradually disappears, the spore showing then a zone of mucilage around it. Another occurrence of spores on the thirty-fifth day was observed in an adult. The

vibron also may be got from the skin at the time of desquamation. M. Le Bel cultivated the vibron, and injected it into a guinea-pig; which, on the tenth day, showed small vibrons in its urine, but did not seem incommoded. The urine in scarlatina and in diphtheria shows a microbacterium and a micrococcus, respectively, both quite different from the vibron of measles.—Existence of zinc in the state of complete diffusion in dolomitic strata, by M. Dieulafait.—On the Marine Carboniferous of Haute-Alsace; discovery of culm in the valley of the Bruche, by MM. Bleicher and Mieg.—On the excitant property of oats, by M. Sanson. He has experimented with Du Bois Reymond's electrical apparatus on the neuromuscular excitability of horses, before and after ingestion of oats, or of an excitant substance, which he isolated from oats (from the pericarp of the fruit); this is called *avenine*, is quite unlike vanilline, is uncrystallisable, brown in mass, finely granular, and has the formula  $C_{56}H_{21}NO_{18}$ . All kinds of cultivated oats elaborate it, but in different quantity; as a rule the white varieties have less than the dark. The quantity seems also to depend on the place of cultivation. Crushing the grain weakens the excitant property. The total duration of the excitation (which grows to a point, then gradually disappears) seemed to be about an hour per kilogramme of oats ingested.

*Errata in last week's report.*—P. 236, top of second column, 7th line, for "Guimareo" read "Guimaraes" 9th line, for "argotised" read "azotised"; 13th line, for "usteria" read "Asteria"; 16th line, for "*pedunculus*" read "*pedunculatus*"; 16th line, for "suctocitiates" read "suctociliates."

## VIENNA

Imperial Academy of Sciences, November 9, 1882.—The following papers were read:—K. Laker, studies on the hæmatic discs (Hayem's hæmatoblasts), and on the so-called dissolution of the white blood-corpuscles in the process of the purification of the blood.—E. Ludwig, note relating to the chemical composition of the damburite from the Scopi Mountain (Graubündteng).—T. Herzig, on guaiaconic acid and guaiac acid.—On the action of nitrous acid on guaiacol, by the same.—A. Grunow, preliminary communication on the Diatomaceæ collected by the Austro-Hungarian North Polar Expedition.

November 16, 1882.—The following papers were read:—N. Polejéff, on the sperm and spermatogenesis of *Sycandra rajahamus Heckelii*.—F. v. Hauer, new contributions to the knowledge of the elder tertiary Brachiura fauna of Vicenza and Verona (Italy).—M. Margules, note on the dynamo-electric process.—A. Tarlomek, contributions to mechanical theory of heat.—K. Zelbr, on the comet Schmidt, October 9, 1882.—A sealed paper dated from November 6, 1882, was opened and read containing a short note by Josef Popper, on the transmission of power and the realisation of unused natural powers by electricity.

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